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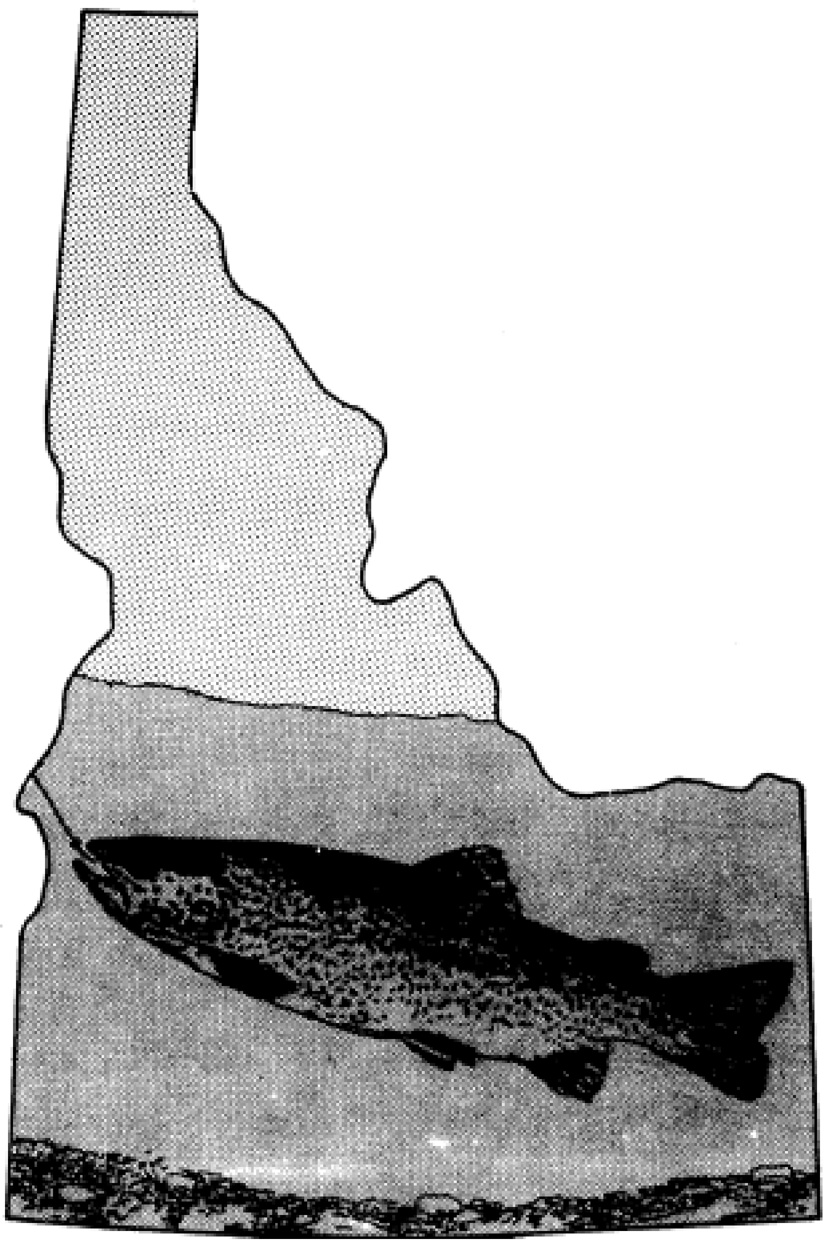
Net Economic Value of Cold and Warm Water Fishing in Idaho

Cindy F. Sorg
John B. Loomis
Dennis M. Donnelly
George L. Peterson
Louis J. Nelson



Abstract

Net willingness to pay for cold and warm water fishing in Idaho was estimated at $42.93 and 42.18 per trip, respectively, with the Travel Cost Method, and at $22.52 and $16.35 per trip, respectively, with the Contingent Value Method. Willingness to pay was greater for increased catch or fish size.

Acknowledgement

This study was a cooperative effort of the Idaho Department of Fish and Game, the University of Idaho College of Forestry, Wildlife, and Range Sciences, the USDI's Bureau of Land Management and the Fish and Wildlife Service, and the USDA Forest Service.

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Cindy F. Sorg, Research Wildlife Biologist
Rocky Mountain Forest and Range Experiment Station[1]

John B. Loomis, Economist
USDI Fish and Wildlife Service[2]

Dennis M. Donnelly, Research Forester
Rocky Mountain Forest and Range Experiment Station[1]

George Peterson, General Research Engineer
Rocky Mountain Forest and Rang Experiment Station[1]

and

Louis J. Nelson, Staff Biologist
Idaho Department of Fish and Game[3]

[1]Headquarters is in Fort Collins, in cooperation with Colorado State University.
[2]USDI Fish and Wildlife Service, Western Energy and Land Use Team, Fort Collins, Colo.
Loomis is now Assistant Professor, University of California, Davis.
[3] Idaho State Fish and Game Headquarters in Boise, Idaho.

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MANAGEMENT IMPLICATIONS

That recreation associated with wildlife has economic value is obvious. However, estimates of what constitutes this value vary widely by species and by state. In part, this is due to the different definitions and estimation techniques used by wildlife biologists, economists, and resource managers. This bulletin uses results from a state-wide survey in Idaho to estimate the values of cold and warm water and mixed species fishing, using both consumer surplus and expenditures as components of total value for consumptive use of the resource.

The net economic value (consumer surplus) of a cold water fishing trip to the angler and to the Nation is $42.93. This means the typical angler would be willing to pay an additional $43 per trip over and above current expenditures. The gross value is the sum of the $37 of expenditures (transportation, lodging, food, tackle) plus the consumer surplus of $43 which equals $80 per trip. For warm water fishing the net economic value per trip is $42, and the expenditures were $24 per trip; therefore, the gross economic value is $66 per trip. These values are state averages from which one can derive per day or per Recreation Visitor Day (RVD) values. It is important to note the exact nature of the net values reported in this bulletin. These state average values of cold and warm water fishing are weighted averages over all fishing sites in Idaho. The weighting is on the basis of number of trips to each site. Those sites with more visits, and consequently more consumer surplus, contribute relatively more weight to the average value.

Actual forest planning or project-related analyses (e.g., environmental assessments) should use the individual site values, reported in tables 4 and 5, rather than the state average. Theoretically, marginal values rather than average are the correct values to use in decisionmaking concerning economic efficiency. Due to the statistical properties (e.g., functional form) of the demand curve estimated for cold and warm water fishing, the individual site average value per trip equals the marginal consumer surplus per trip. That is, the additional net value to the angler and society of another trip is equal to the average value of a trip. These average values can thus be applied where marginal values are appropriate because the functional form chosen for the demand curve has the unique property that consumer surplus marginal and average values are equal. (See Appendix 1 for a discussion and proof.)

If the decisionmaker is evaluating the economic benefits of alternative investments in fisheries management, then the net value of $43 for cold water and $42 for warm water fishing is the appropriate value to use per trip. These values can be converted to a 12-hour RVD for use in FORPLAN or Benefit Cost Analyses. Converting trip values to RVD values based on number of days per trip and hours fished per day yields $63.87 per RVD for cold water fishing and $63.26 per RVD for warm water fishing.

These net economic values were derived by a demand curve estimating technique called the Travel Cost Method (TCM). This approach statistically infers the bid that anglers would make if given the opportunity to express willingness to pay. The Contingent Value Method (CVM) was also used in the study to elicit simulated market bids from anglers. This approach was used to measure the value of the last trip taken during the year. The per trip values were $22.52 for cold water fishing and $16.35 for warm water fishing. These convert to a net economic value per RVD of $37.75 for cold water fishing and $33.08 per RVD for warm water fishing.

Although angler expenditures are useful for evaluating the impact on communities dependent upon tourism, they are not a measure of net economic value. Much like the harvesting and transportation expenditures of logging contractors, angler expenditures can be used in Input-Output models such as IMPLAN or BREAM to calculate the multiplier effects of expenditures on local income and employment.

INTRODUCTION

The economic value of wildlife as measured from the National or economic efficiency view is used in Federal land management planning by the USDA Forest Service and USDI Bureau of Land Management. While the land or habitat may be managed by the Federal government, the wildlife is property of the State. Coordination of economic value is necessary if Federal plans affecting habitat are to be compatible with the state plans for management of individual species.

Specifically, this bulletin analyzes the net willingness to pay for cold water and warm water fishing. The value of steelhead fishing is analyzed in a separate bulletin (Donnelly et al. 1985). Federal agencies and the State of Idaho will have a consistent set of dollar values which vary by the type of fishing (cold, warm, and mixed) and by site. These numbers may serve as the basis of discussions on value of wildlife in National Forest planning, BLM range-wildlife investments and Forest Service Resource Planning Act (RPA) assessments.

The underlying premise of this study was that by using data from a survey reviewed by all parties, using methodologies acceptable to all parties, and applying standard statistical techniques, all parties would reach consensus on resulting dollar values. In addition, this study served as a test of the cost effectiveness of using the Travel Cost Method and the Contingent Value Method for developing values for the 1990 RPA assessments.

METHODOLOGY

Definition of Economic Value

Economic values for all outputs are defined in terms of net willingness to pay (amount in excess of actual expenditures) by users. This is the value of forage to ranchers from ranch budgets, the value of water to farmers, and the value of wildlife to hunters-anglers.

Net willingness to pay is the standard measure of value in Benefit-Cost Analysis performed by the U.S. Army Corps of Engineers, Bureau of Reclamation, and the Soil Conservation Service (U.S. Water Resources Council, 1979, 1983). Net willingness to pay is the basis of the Resources Planning Act values used by the USDA Forest Service in National Forest Planning. The Rangeland Investment Policy of the Bureau of Land Management stipulates willingness to pay as the measure of value of all outputs in SAGERAM analysis (Bureau of Land Management 1982).

Use of actual angler expenditures is not appropriate for valuation of wildlife nor for valuation of other resources (Knetsch and Davis 1966). Expenditures are only useful for measuring the effect or impact on local economies of some resource management action.

Techniques for Measuring Net Willingness to Pay

Dwyer et al. (1977), the U.S. Water Resources Council (1979, 1983), Walsh (1983), and Knetsch and Davis (1966) all recommend the Travel Cost Method (TCM) and the Contingent Value Method (CVM) as conceptually correct techniques for empirically estimating users' net willingness to pay.

The TCM relies on variations in travel costs of recreationists to trace out the demand curve. The area under this demand curve but above actual travel costs is a measure (called consumer surplus) of net willingness to pay. For readers unfamiliar with TCM see Clawson and Knetsch (1966), or Dwyer et al. (1977).

The CVM asks users directly to state their net willingness to pay for current or proposed conditions. Since it is a direct measure of consumer surplus, survey design is a critical factor in this method.

Travel Cost Method (TCM)

In this study a Regional Travel Cost Model (RTCM) was constructed. The dependent variable, i.e., the variable we are trying to predict and explain, is trips per capita. The traditional "per capita" specification was used to adjust for population differences between counties of visitor origin. As Brown et al. (1983) show, trips per capita accounts for both the number of visits as a function of distance and also probability of visiting the site as a function of distance. Alternatively, population could be incorporated as an independent variable (Knetsch et al. 1976).

The list of possible independent variables includes a surrogate for price (i.e., distance), fishing site characteristics, measures of substitutes, and the demographic characteristics of anglers. Given the constraints on length of the angler survey, measurement of several site-specific characteristics was precluded; therefore a relatively simple RTCM was estimated.

The basic model is:

$$\frac{\text{Trips}_{ij}}{\text{Pop}_i} = b_0 - b_1\text{Dist}_{ij} + b_2\text{Quality}_j - b_3\text{Subs}_{ik} \pm b_4\text{Income}_i \qquad [1]$$

where Dist = round trip distance in miles from county residence (i) to fishing site (j).

Quality = a measure of fishing quality at the site; e.g., fish caught per trip, fish caught per hour, or hours fishing per day.

Subs = a measure of the cost and quality of substitute fishing sites (k) to origin i relative to the one under consideration, i.e., site j.

Income = a measure of ability of county i households to incur costs for recreation and a proxy for other taste variables.

$b_0 - b_4$ = coefficients to be estimated.

Equation [1] specifies the per capita demand curve for the fishing sites in the region. By setting the quality measure at a value associated with a specific site, the general RTCM demand curve becomes the demand curve for that specific site. Thus, with one equation one can model recreation visitation patterns for all sites in the region. Equation [1] states that trips per capita from origin i to site j is a function of the distance from origin i to site j, the quality at site j, the substitute sites k available to origin i and the income of residents of origin i.

From a per capita demand curve a second stage demand curve can be calculated for a specific site. This second stage demand curve plots total trips to a site as a function of hypothetical added distance. Once the added distance is converted to travel costs (in dollars), the area under the second stage demand curve represents net willingness to pay. It is net willingness to pay, the willingness to pay over and above the travel costs actually incurred. (Clawson and Knetsch 1966, Dwyer et al.

1977). Finally, the total site consumer surplus can be converted to net economic value per day by dividing by the number of trips and then dividing this figure by days per trip.

The estimate of net willingness to pay is the end result of a series of mathematical and statistical operations on the aggregated data. One item of interest about estimated net willingness to pay is the sensitivity this estimate exhibits in response to variation within the travel cost model. This variation is initially seen in the computed statistical confidence interval associated with the estimate of each coefficient of the visits per capita regression model. Conceptually, this variation is carried through all the steps described above, including formation of the second stage demand curve and the subsequent integration under it. Thus, it is logical to talk about variation associated with estimated net willingness to pay.

However, the exact statistical properties of the confidence interval estimates of net willingness to pay are not yet completely developed.[4] Despite this, certain aspects of sensitivity may reveal information about the variability of benefit estimates. Specifically for this research a "sensitivity interval" was defined. This interval is for estimated benefits measured by willingness to pay and describes what are the upper and lower bounds of the benefit estimate when the regression coefficient of distance is varied to the upper and lower bounds of its confidence interval.

For example, the computer program that computes benefits is run three times once with the distance coefficient at its best unbiased level, once with it at the lower level of its 95% confidence interval, and once with the distance coefficient at the upper level of its 95% confidence interval.

The three estimates of benefits indicate how benefits vary with respect to variation in the coefficient associated with distance. Distance is chosen specifically because increased increments of this independent variable measure additional cost hypothetically incurred by anglers. Later in this report, these sensitivity intervals are compared to the confidence intervals derived from the contingent value method. This comparison is not a statistical procedure per se, but it does provide an indication of the relative ranges in estimates produced from each method. Because of the functional form of the demand curve used in this study, sensitivity intervals on average trip values are likely to be good approximations of true trip value confidence intervals.

Contingent Value Method (CVM)

The CVM is also known as the "direct method" since the interviewer directly asks the recreationists what they would be willing to pay to fish at this particular site. The object is to determine each individual's net willingness to pay for fishing at a site relative to all alternative sites. The issue is not the value of fishing itself. The survey design can also involve elimination or addition of one or more fishing sites, not the elimination of fishing in general.

There are several ways to ask the bidding game question. Because a telephone interview was to be used, the iterative technique was chosen. The iterative technique involves repeatedly asking if the person would pay successively higher and higher amounts of money. Once the person reaches the maximum amount he or she would pay, then this final value is recorded.

Another aspect of survey design is to determine the appropriate "payment vehicle." That is, how is the money bid going to be paid. One can use entrance fees, license fees, taxes, trip costs, or payment into a special fund. In this study, trip cost was used as the payment vehicle because it was fairly neutral and familiar to the respondents. Entrance or license fees may provide an emotional reaction biasing answers, in that an individual bid reflects bias toward the payment vehicle used and not the value of the resource of interest. In order to identify individuals who are responding negatively to the payment vehicle or the survey itself, the survey should include a protest mechanism. By allowing individuals to identify bias toward the payment vehicle or survey, these responses can be excluded from data analysis. The specific question asked is shown in the questionnaire which is reproduced in Appendix 2.

The analyses of CVM results is quite straightforward when analysis is based on a sound survey. Generally, the mean willingness to pay is calculated after removing protest bids and identifying outliers.

One advantage of CVM over TCM is the researcher can estimate willingness to pay not only for current conditions but also for hypothetical changes in fishing quality. In this study we asked additional willingness to pay for doubling the number of fish caught (versus current catch) and doubling size of the fish (relative to current size). This provides some important management information. Often times the number of fishermen may not increase when fisheries improvements are made. But fishery improvements appear to increase the value per day.

Another advantage of CVM is that the value per day associated with fishing on trips that were multi-purpose or multi-destination can still be estimated. With TCM, one can accurately value only trips for which the primary purpose and primary destination was for fishing. Thus in this study we will be able to estimate the value of cold water and warm water fishing for both primary and non-primary purpose trips.

One criticism of CVM is the hypothetical nature of the value derived because it is not based on actual observed behavior. Research by Bishop and Heberlein (1979) and Brookshire et al. (1982) indicates that rather than an overstatement of willingness to pay, CVM generally provides conservative estimates of willingness to pay.

[4]Personal communication from Rudy King, Biometrician, Rocky Mountain Forest and Range Experiment Station, to Dennis Donnelly, October 3, 1983.

SURVEY DESIGN AND IMPLEMENTATION

The population sampling frame for this study was resident and nonresident anglers having an Idaho fishing license in 1982. The sampling rate for residents was 0.6% or 1,758 Idaho residents. A total of 194 nonresidents were sampled. The sampling rate for nonresidents varied by license type, varying from 0.34% for season nonresident to 0.104% for one day nonresident license holders. This inadvertent nonresident undersampling was adjusted for in the data set by increasing the number of trips for the undersampled populations until the sampling percentages were equal. Since data were later aggregated, this adjustment technique was deemed acceptable. Only nonresident sampling needed adjustment. The overall sample provided information on 14,552 cold water fishing trips, 4,481 mixed species fishing trips and 1,771 warm water fishing trips. Only for warm water fishing was the number of trips so small as to make individual site estimates unreliable. In displaying benefit estimates, warmwater sites were grouped together by areas to partially overcome this problem.

The 1,952 fishermen were first mailed a letter of introduction from the University of Idaho's College of Forestry, Wildlife and Range Sciences. Included with the letter was a map identifying the fishing units in Idaho (see fig. 1). The map was included to assist the respondents in determining the locations or sites which were visited during 1982. The letter indicated that someone from the University would be calling to collect fishing information requested in the letter. The individuals were asked to list their trips ahead of time, so that their answers could simply be read back over the phone. Additional questions were asked during the telephone interview (see questionnaire in Appendix 2). The actual telephone survey was performed by personnel at the University of Idaho during the months of February and March 1983. The data collected reflected trips taken for the entire 1982 fishing season. This approach proved quite successful in obtaining a response rate of 99%, with only 19 nonresponses out of the 1,952 persons contacted.

The survey collected trip information, party size, fishing quality, and fish species sought. For the Travel Cost Model analyses, trips were screened to insure that fishing was the primary purpose and that visitation of that particular site was the primary destination of a trip. The intent was to eliminate from the TCM analyses multi-destination and multi-purpose visits that were not dependent on the availability of fishing. The respondents were asked to report the round trip distance traveled to each site that was visited. This variable became the price variable for the TCM analysis. The number of days fished on the trip and the number of hours fished per day were also elicited from the respondent. This information will be used to convert TCM and CVM dollar values to 12 hour RVD values as required for Forest Service analyses. Since the questionnaire did ask for trip information for the previous year, accuracy of respondent recall is of concern. However, the use of zone averages tends to minimize the statistical effects of recall error on coefficient estimates (Brown et al. 1983). Future research may be able to provide some insights on the accuracy of annual recreation surveys.

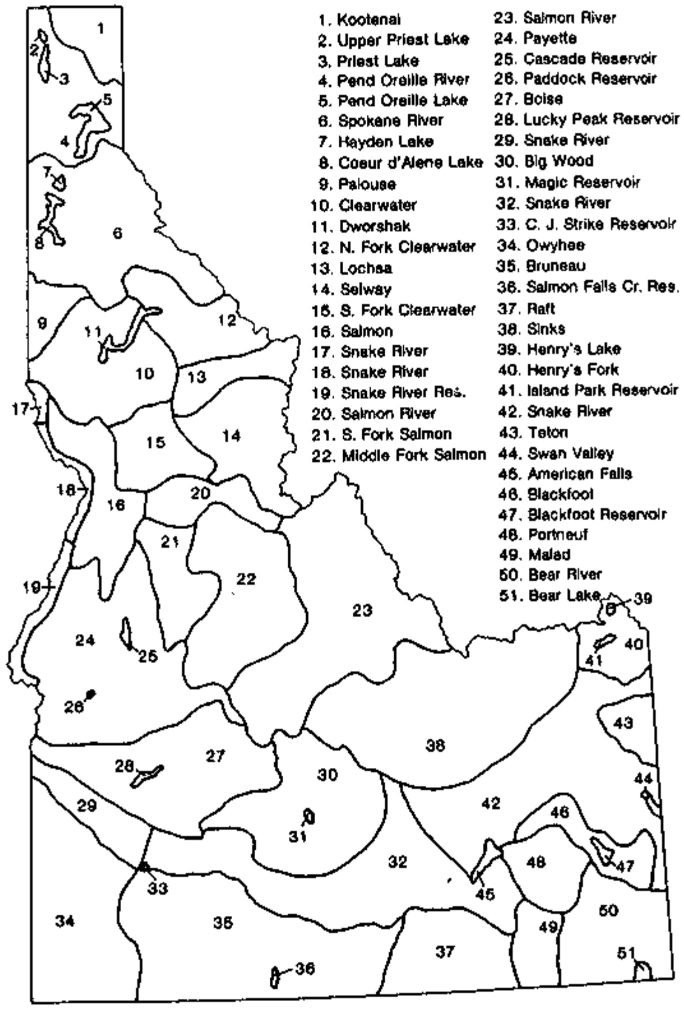

Figure 1.—Idaho fishing areas.

The CVM bidding questions were asked with regard to the last trip to estimate the value of this trip regardless of whether it was a primary or non-primary purpose fishing trip. Calculation of mean bids from CVM were separated by primary and non-primary purpose. The primary purpose bids could then be compared to TCM estimates.

The fish species sought was also recorded so that TCM and CVM values for cold water and warm water fishing could be calculated separately.

STATISTICAL ANALYSIS

Data Compilation

There were two basic phases to the analyses of the Idaho fishing data. First, an analysis of mean net willingness to pay from the CVM was performed after outliers were removed. Possible outliers included those bids over $100. For each bid over $100, the individual case was screened for length of trip, site visited, hours fished and whether the trip was a primary purpose. Based on these variables, a subjective decision was made as to the validity of the bid. For any species less than three percent of the sample was removed as high bid outliers. The minimal time required in calculating CVM derived net willingness to pay values makes CVM attractive as a methodology for rapid valuation of wildlife benefits. In addition, the capability to value all wildlife use whether primary purpose or not is another asset.

Concurrently with the CVM analysis, the TCM analysis was begun. Data were separated by cold water and warm water fishing trips. Mixed species fishing trips were appended to both the cold water and warm water data sets because mixed fishing involved both species and statistical tests indicated mixed fishing was similar to both groups (test from Kmenta 1971; p. 373). The hypothesis tested the possibility that the coefficients of the cold water fishing regression may not be different from those of mixed species fishing. Therefore, the null hypothesis was that the coefficients were not different across the regressions. The mixed species data set was appended to the cold and warm water data sets only to aid in estimating the per capita demand curve. Since the primary purpose of the study was not to estimate total site consumer surplus but rather average consumer surplus per trip there is no double counting of mixed species fishing benefits. As will be discussed in Results section, the average consumer surplus for mixed species fishing at each site is estimated by its own second stage demand curve which is derived from the pooled per capita curve.

The next step was to aggregate the individual cases into counties or in some cases, county groups. By dividing county populations into trips from a county, trips per capita from each county of visitor origin could be calculated. Once the data were aggregated, measures of substitute site attractiveness and site quality were calculated. Past approaches used exogenous information on physical characteristics of the site under study and substitute sites. Since this analysis was, in many respects, a prototype analysis to evaluate the cost-effectiveness of TCM, substitute and quality measures were limited to those which could be derived from the data contained in the survey.

Several site quality measures were formulated to reflect fishing quality and were statistically evaluated. Fish per hour seemed the most logical candidate but this rate variable proved to be statistically insignificant in all regression equations. Considered next was a measure of total fish catch at the site by individuals in our survey. The hypothesis here was the more fish taken out of a site, the greater the word-of-mouth information on fishing success and hence, the higher the visitation rate. The total fish caught variable was statistically significant for both cold and warmwater regressions.[6] This is fortunate for several reasons. First, this variable allows better identification of an individual site when using the RTCM. Second, it is a management relevant variable.

[6]*Use of total fish harvest avoided statistical problems that Meyer et al. (1983) found when they used fish harvest per capita. Since the dependent variable in their model was visits per capita the two terms appeared to have interacted in a way that biased the estimates of the other coefficients. Personal communication with William G. Brown, February 1984.*

That is, the State Department of Game and Fish can influence total fish caught through habitat management, stocking programs and fishing regulations. The total fish catch variable can be used to estimate the economic efficiency benefits (in a benefit-cost sense) of any of the Game and Fish actions taken to increase total fish caught. That is, because fish harvest is a demand curve shifter, the marginal benefits of any management action that changes fish harvest can be calculated as the area between the old and new demand curves (Freeman 1979).

Incorporation of a variable to reflect substitute recreation opportunities followed the basic approach of Knetsch et al. (1976). Their substitute measure reflects the price of substitute sites, quality of substitute sites and availability of such sites. The price of substitute sites is given by the distance from the origin i to the alternative site k. The quality of substitutes is approximated in this study by the total number of fish harvested at the alternative sites k. A substitute index is calculated by dividing harvest at alternative site k by distance from origin i to site k. This ratio is essentially a measure of the cost effectiveness of site k to recreationists in origin i. Specifically the ratio can be thought of as fish harvested per mile of driving. Any site k having a fish per mile greater than the fish per mile of the site under study, becomes a cost-effective substitute. To account for the degree of availability of these substitutes for a given origin-site combination, the substitute index is the sum of these substitute ratios for all alternative site k's having a ratio greater than the ratio for origin i - site j.

Mathematically,

$$S = \frac{H_k}{D_{ik}} \quad \sum \text{for all} \quad \frac{H_k}{D_{ik}} > \frac{H_j}{D_{ij}}$$

where
H = harvest
D = distance
j = site being studied
k = potential substitute site for site j.

The greater the number of alternative sites that are more cost-effective than the site j visited, the larger this substitute index is for j. The larger the value of the substitute index, other things remaining equal, the lower visits per capita ought to be to site j from origin i. Therefore, one would normally expect a negative sign on the substitute term. In this study, consideration of substitute sites was limited to alternative sites visited by any person coming from a given origin. Statistical estimation would not allow evaluation of the price to every site that a person could conceivably visit. This adopts the approach of Mendelsohn and Brown (1983) which relies on the Household Production theory view that observed behavior of visitation traces out an efficient recreation characteristic frontier where the key characteristic here is harvest. Thus, sites not actually visited by any persons from a given origin are assumed not to be cost-effective substitutes. This clearly narrows the range of sites possibly considered as substitutes. Whether this narrowing is empirically important cannot be determined without a case study comparing the Mendelsohn and Brown (1983) approach and the full substitute approach.

County per capita income was also tested as a variable because economic theory indicates that it would influence the ability of county residents to purchase trips to a recreation site. In economics, goods for which purchases rise with income are classified as "normal goods." Goods that have purchases fall as income rises are called "inferior goods." This latter term does not imply inferior in quality or in any social sense. Rather it refers to a relationship between quantity demanded and income. Hamburger is often considered an "inferior good" to many consumers because we observe as income rises, that less hamburger (and more steaks) are bought.

Regression Analysis

In regression analysis the determination of which of the potential variables in the full model to retain depends on their statistical significance. Variables that were consistently insignificant were generally dropped from further consideration. The issue of functional form was not so straightforward. The model in equation [1] discussed previously was the simplest form.

In addition, several alternative specifications were proposed:

$$\ln(\text{trips/pop}) = b_0 - b_1\text{Dist} + b_2\text{Totfish} - b_3\text{Subs} \pm b_4\text{Inc} \pm b_5(\text{Inc})^2 \quad [2]$$

$$\ln(\text{trips/pop}) = b_0 - b_1\text{Dist} + b_2\text{Totfish} - b_3 \ln \text{Subs} \pm b_4\text{Inc} \pm b_5(\text{Inc})^2 \quad [3]$$

$$(\text{trips/pop}) \cdot (\sqrt{\text{pop}}) = \sqrt{\text{pop}}\, b_0 - b_1[\ln\text{Dist}](\sqrt{\text{pop}}) + b_2\text{Totfish}\,(\sqrt{\text{pop}}) - b_3\text{Subs}\,(\sqrt{\text{pop}}) \pm b_4\text{Inc}\,(\sqrt{\text{pop}}) \pm b_5\,(\text{Inc})^2\,(\sqrt{\text{pop}}) \quad [4]$$

Equation [2] and [3] adopt the functional form that several economists have argued is most plausible. Ziemer et al. (1980), Vaughan and Russell (1982), and Strong (1983) contend that given the pattern by which trips per capita falls off at higher distances, the natural log of visits per capita is preferred to either a linear functional form or natural log of distance as in equation [4]. Their point is that with either two of these latter functional forms negative visits will be predicted for a few high cost zones; negative visits is counter intuitive and thus provides credence for the natural log of visits per capita.

With an untransformed dependent variable, Bowes and Loomis (1980) contend that the unequal sizes of population zones require a square root of population weighting factor (eq. [4]) to correct for heteroskedasticity and thus improve both benefit and use estimates. Vaughan and Russell (1982) and Strong (1983) show that if the log of visits per capita is chosen as the functional form (equations [2] or [3]), the heteroskedasticity will be so greatly reduced that the weighting by square root of a population may be unnecessary.

Which specification works best depends on the specific data base. The approach taken in this study was twofold. First, a Regional Travel Cost Model was being developed for estimating benefits at an existing set of sites, not for use estimation at a new site. Therefore, we used an econometric test suggested by Rao and Miller (1965) to determine whether the natural log of visits per capita or natural log of distance performed best. The hypothesis tested to determine the form of the dependent variable to use involved comparing the residual sum of squares between two specifications of the dependent variable. The test of the form of the dependent variable considered the chi-squared distribution. The null hypothesis tested whether the two functions (visits per capita and log of visits per capita) were empirically equivalent. The null hypothesis was rejected indicating the log of visits per capita better fit the data. Next, estimated visits were compared with actual visits. If estimated visits were fairly close to actual visits ($\pm$ 20%), the natural log of visits per capita was adopted rather than Bowes-Loomis weighting (which does provide exact prediction of actual sampled visits). This settlement of the trade-off depends on whether use or benefit estimation is the critical factor in one's study objectives. In this study, benefit estimation was most critical.

Income and income squared were used in the regression equation because income does not necessarily enter in a linear fashion (Martin et al. 1974). For example, as income increases we may increase our fishing activity. However, further increases in income do not always result in proportional (i.e., linear) increases in fishing. That is, if income doubles fishing may not double. If income doubles, cruises in the Caribbean may be substituted for more reservoir fishing.

Calculation of TCM Benefits

To calculate benefits with distance as the price variable using the second stage demand curve approach it is necessary to convert distance to dollars. Travel cost to a site consists of transportation costs and travel time costs. Travel time is included because other things remaining equal, the longer it takes to get to a site the fewer visits will be made. That is, time, because it is often a limiting factor, acts as a deterrent to visiting more distant sites. As is well known, omission of travel time will bias the benefit estimates downward (Cesario and Knetsch 1970, Wilman 1980). The U.S. Water Resources Council (1979, 1983) requires consideration of travel time in performing TCM studies.

In this study, round trip mileage driven was converted to transportation costs using three steps. First, mileage was converted to transportation cost on a per vehicle basis. This was done using variable automobile costs as listed by the U.S. Department of Transportation's (1982) Cost of Owning and Operating Automobiles and Vans. Based on the number of persons per vehicle and the fact that a large number of fishing trips were overnight camping trips, it was likely that many persons may have used an intermediate size car. While some anglers may have gone in compact cars, others may balance this by going in large cars, pickups trucks, or vans. Thus, the intermediate size car was taken as typical. This had a cost of \$0.135 per mile in 1982 (U.S. Department of Transportation 1982). Interestingly enough, dividing transportation costs reported by respondents by their round-trip miles yields a cost per mile of \$0.126 and \$0.129 for warm water and cold water fishing, respectively. Therefore, $0.135 was used in this analysis. Benefit estimates using the lower cost per mile would be trivially smaller.

The value of travel time was set at one-third of the wage rate as per the U.S. Water Resources Council (1979, 1983). This is the mid-point of values for travel time that Cesario (1976) found in his review of the transportation planning literature. However, the use of one-third the wage rate is not necessarily intended to measure wages foregone during the time spent traveling, but rather the deterrent effect of scarce time on which sites to visit. In this study, the U.S. Department of Labor's estimate of a median wage of $8.00 an hour was used. One-third of this is $2.67 per hour.

For each increment of distance or added miles, the transportation cost and value of travel time for that added distance is added together. This rescales the vertical axis of the second stage demand curve from miles to dollars. The area under the second stage demand curve yields estimated site consumer surplus for the sampled anglers. Dividing sample consumer surplus by sampled trips yields consumer surplus per trip to that site.

RESULTS

Contingent Value Method

Primary Purpose Trips

Table 1 presents the dollar values for primary purpose and non-primary (multiple) purpose trips. The value in brackets in table 1 reflects the mean bid with high bid outliers removed. Unfortunately there is no standard procedure for determining what is a high bid outlier. Initially, all bids over $100 per trip were screened as potential high bid outliers. To determine if the bid was an outlier, trip length in days and hours of fishing per day were screened. If trip length was very short or hours fished minimal, the bid was subjectively removed as a high bid outlier. For example, a bid of $240 for double fish caught by a person on a one-day trip was considered a high bid outlier. Because no individual income data were collected, it was difficult to tell if such a bid was within the angler's ability to pay. In the primary trip category, the mixed species fishing values were most affected by excluding one or more high bid outliers. There were also several high bid outliers on the more hypothetical questions such as "doubling fish caught" and 50% increase in fish size. Since these questions were more hypothetical than the current condition questions, this may be expected. The following discussion is based on the bracketed values.

For primary purpose trips, coldwater anglers are willing to pay $22.52 per trip more than their current expenses rather than not visit this site. This $22.52 is associated with 1.58 days per trip. The value per day is $14.25. On a 12-hour Recreation Visitor Day basis, the value would be $37.75 since there was a mean of 4.53 hours fished per day.

For warm water fishing, anglers were willing to pay $16.35 per trip more than their current expenses rather than not visit the site. This $16.35 is associated with 1.36 days per trip. This represents $12.02 per day. With 4.36 hours fished per day, this translates to $33.08 per 12-hour RVD. Fishing for both warm water and cold water species at the same site had a net willingness to pay of $17.61 per trip. This translates to $28.90 per 12-hour RVD.

The results for doubling number of fish caught and 50% increase in fish size provide some economic values useful for fisheries management. The bids per trip increased from $22.52 to $31.87 if number of cold water fish caught (but not necessary kept) doubled. This value of extra fish caught may be helpful in establishing the economic benefits of greater fish populations. For warm water fishing the increase in value for doubling the number of fish caught is $7.91. For increasing fish size, net willingness to pay increases even more per trip. The net willingness to pay for increasing by 50% the size of coldwater fish species caught was worth $12.78 per trip. For warmwater species, increasing fish size by 50% was worth $9.81 per trip; for mixed fishing, it was worth $9.23 per trip. Desirable increases in fish size could be accomplished by holding fish at a hatchery until they are larger or implementing a catch and release program for fish under a certain size. The additional benefits of larger fish could be compared to the costs of managing to produce larger fish.

Non-Primary (Multiple) Purpose Trips

Multiple purpose trips were defined as trips where fishing was not the major reason for visiting a site and/or visiting this particular site was not the primary destination of the trip. These trips could not be analyzed using the Travel Cost Method because it would be incorrect to attribute the distance driven to the site as an indirect measure of price paid for fishing. The net willingness to pay for multiple purpose cold water fishing trips was $39.71 per trip. This translates to $21.01 per day and to $68.70 per 12-hour RVD. For warm water fishing, the value of these non-primary purpose trips is $19.36 or $11.39 per day. This translates to $37.86 per 12-hour RVD. Mixed fishing trips had a value of $50.98 or $24.03 per day. Per 12-hour RVD this value is $75.75.

The multiple purpose users contribute important benefits to the cold water and mixed sites. About 20% of cold water anglers visiting these Idaho sites were on non-primary purpose trips. The same is true for mixed species anglers. For warmwater fishing, non-primary purpose trips contributed about 12% to the value of these sites.

Table 2 represents average dollar values per trip based on combining coldwater fishing with mixed and warmwater fishing with mixed. These values may be useful for fisheries that support both types of species. Note the bracketed values presented in table 2 represent values when the high bid outliers are removed. Thus, the numbers in brackets in table 2 can be compared to the numbers in brackets in table 1.

Table 3 reports values for each of the coldwater fishing sites. Table 4 reports values for warmwater fishing regions; these regions were formed to account for the

Table 1.—CVM values[1] for cold, warm, and mixed water fishing (sample size in parentheses)

	Cold Water Fishing		Warm Water Fishing		Mixed Fishing	
Primary Purpose						
Net willingness to pay for current conditions	$24.77 (776)	[$22.52][2] (769)	$17.72 (79)	[$16.35][3] (78)	$22.15 (141)	[$17.61] (137)
Net willingness to pay for double number of fish caught	$32.47 (774)	[$31.87] (768)	$27.53 (78)	[$24.26] (76)	$29.21 (140)	[$23.18] (138)
Net willingness to pay for 50% increase in fish size	$38.03 (773)	[$35.30] (762)	$27.52 (79)	[$26.16] (77)	$33.41 (139)	[$26.84] (136)
Number of fish caught on trip	5.00 (795)		9.79 (84)		6.89 (142)	
Number of days fished on trip	1.58 (980)		1.36 (113)		1.53 (181)	
Hours fished per day	4.53 (980)		4.36 (113)		4.78 (181)	
Value per day for current conditions	$14.25		$12.02		$11.51	
Value per 12-hour RVD for current conditions	$37.75		$33.08		$28.90	
Cost (travel, food, tackle, accommodations	$37.05 (963)		$24.62 (111)		$35.06 (179)	
Multiple Purpose						
Net willingness to pay for current conditions	$42.73 (201)	[$39.71] (198)	$19.36 (11)		$80.71 (42)	[$50.98] (41)
Net willingness to pay for double number of fish caught	$58.44 (200)	[$51.03] (198)	$22.45 (11)		$106.00 (42)	[$58.59] (41)
Net willingness to pay for 50% increase in fish size	$64.31 (200)	[$53.88] (197)	$28.45 (11)		$112.78 (41)	[$64.61] (40)
Number of fish caught on trip	7.39 (203)		7.00 (12)		4.82 (45)	
Number of days fished on trip	1.89 (256)		1.70 (15)		2.12 (56)	
Hours fished per day	3.67 (255)		3.61 (13)		3.81 (56)	
Value per day for current conditions	$21.01		$11.39		$24.05	
Value per 12-hour RVD for current condition	$68.70		$37.86		$75.75	
Cost (travel, food, tackle, accommodations)	$66.27 (253)		$30.93 (14)		$57.07 (56)	

[1] *Bracketed values have outliers removed.*
[2] *95% confidence interval: $19.95 to $25.08.*
[3] *95% confidence interval: $10.36 to $22.34.*

Table 2.—CVM values[1] for cold/mixed water fishing and warm/mixed water fishing (sample size in parentheses).

	Cold/mixed water fishing		Warm/mixed water fishing	
	Single Purpose			
Net willingness to pay for current conditions	$24.36 (917)	[$21.77][2] (906)	$20.56 (220)	[$17.15][3] (215)
Net willingness to pay for double number of fish caught	$31.96 (914)	[$30.83] (905)	$28.61 (219)	[$25.68] (214)
Net willingness to pay for 50% increase in fish size	$37.31 (912)	[$34.22] (898)	$31.30 (217)	[$26.80] (212)
Number of fish caught on trip	5.29 (937)		7.97 (226)	
Number of days fished on trip	1.57 (1161)		1.47 (294)	
Hours fished per day	4.57 (1161)		4.62 (294)	
Value per day for current conditions	$13.86		$11.67	
Value per 12-hour RVD for current conditions	$36.39		$30.31	
Cost (travel, food, tackle, accommodations.	$36.74 (1142)		$31.06 (290)	
	Multiple Purpose			
Net willingness to pay for current conditions	$49.29 (243)	[$44.12] (242)	$67.98 (53)	[$44.29] (52)
Net willingness to pay for double number of fish caught	$66.66 (242)	[$61.49] (242)	$88.66 (53)	[$50.94] (52)
Net willingness to pay for 50% increase in fish size	$72.66 (241)	[$63.42] (240)	$94.19 (52)	[56.94] (51)
Number of fish caught on trip	6.92 (248)		5.28 (57)	
Number of days fished on trip	1.93 (312)		2.03 (71)	
Hours fished per day	3.70 (311)		3.77 (69)	
Value per day for current conditions	$22.86		$21.82	
Value per 12-hour RVD for current conditions	$74.14		$69.45	
Cost (travel, food, tackle, accommodations	$64.60 (309)		$51.84 (70)	

[1] *Bracketed values have outliers removed.*
[2] *95% confidence interval: $19.43 to $24.12.*
[3] *95% confidence interval: $12.92 to $21.39.*

Table 3.—TCM and CVM values derived for coldwater fishing at designated sites in Idaho (sample size in parentheses)

Site	TCM	Contingent Value Method (CVM)							
	Net WTP for current conditions	Net WTP for current conditions	Net WTP for double no. of fish caught	Net WTP for 50% increase in fish size	No. of fish caught on last trip	No. of days fished on last trip	Hours fished per day	No. of licensed anglers	Cost (travel, food, tackle, accommodations)
1	$36.70	$5.00 (7)	$6.57 (7)	$8.29 (7)	4.71 (7)	.85 (10)	3.45 (10)	1.80 (10)	$7.90 (10)
2	$41.83	$5.00 (2)	$5.00 (2)	$9.00 (2)	2.00 (2)	1.67 (3)	2.17 (3)	2.33 (3)	$4.33 (3)
3	$32.92	$71.50 (4)	$71.50 (4)	$130.25 (4)	4.50 (4)	1.90 (5)	4.60 (5)	1.80 (5)	$19.20 (5)
4	$41.99	$6.78 (9)	$10.67 (9)	$13.44 (9)	3.44 (9)	1.00 (9)	3.94 (9)	3.00 (9)	$15.89 (9)
5	$38.99	$24.52 (25)	$39.64 (25)	$40.72 (25)	2.93 (27)	1.58 (33)	6.00 (33)	2.55 (33)	$38.53 (32)
6	$39.66	$20.58 (40)	$24.90 (40)	$30.25 (40)	5.14 (42)	1.40 (48)	3.28 (48)	2.35 (46)	$26.28 (47)
7	$46.16	$6.00 (8)	$8.71 (7)	$5.43 (7)	3.13 (8)	.90 (9)	3.67 (9)	2.11 (9)	$6.44 (9)
8	$36.20	$8.11 (19)	$13.00 (19)	$10.50 (18)	10.74 (19)	.91 (21)	4.00 (21)	2.14 (21)	$19.67 (21)
9	$40.97	$6.40 (5)	$8.40 (5)	$8.80 (5)	2.40 (5)	1.17 (6)	4.42 (6)	3.17 (6)	$5.00 (6)
10	$36.27	$14.98 (41)	$22.07 (41)	$25.93 (41)	2.51 (41)	.97 (48)	5.40 (48)	2.40 (48)	$16.11 (47)
11	$35.38	$24.50 (6)	$27.00 (6)	$32.33 (6)	8.50 (6)	2.13 (8)	5.69 (8)	2.50 (8)	$43.86 (7)
12	$38.45	$24.09 (11)	$26.82 (11)	$30.73 (11)	4.73 (11)	1.29 (12)	4.92 (12)	1.92 (12)	$40.33 (12)
13	$32.63	$59.33 (3)	$62.67 (3)	$62.67 (3)	43.67 (3)	2.96 (5)	4.90 (5)	3.20 (5)	$47.00 (5)
14	$27.38	$10.00 (1)	$10.00 (1)	$10.00 (1)	10.00 (1)	2.00 (1)	4.00 (1)	2.00 (1)	$20.00 (1)
15	$36.56	$21.50 (8)	$23.38 (8)	$24.00 (8)	6.38 (8)	1.81 (11)	3.36 (11)	3.09 (11)	$25.18 (11)
16	$36.08	$44.33 (24)	$51.00 (24)	$56.92 (24)	2.35 (29)	1.74 (31)	4.59 (34)	2.15 (34)	$49.62 (34)
17	$35.54	$15.80 (5)	$24.20 (5)	$28.20 (5)	.60 (12)	1.50 (12)	6.04 (12)	2.17 (12)	$26.67 (12)
18	$51.55	$128.75 (4)	$135.00 (4)	$136.25 (4)	1.25 (4)	2.25 (4)	5.00 (4)	3.00 (4)	$135.00 (4)
19	$40.17	$10.00 (4)	$27.50 (4)	$28.75 (4)	1.33 (3)	1.25 (4)	7.63 (4)	1.75 (4)	$24.25 (4)
20	$37.55	$62.33 (6)	$99.00 (6)	$113.00 (5)	9.00 (5)	3.44 (8)	5.38 (8)	3.25 (8)	$72.29 (7)
21	$51.96	$50.00 (2)	$50.00 (2)	$52.50 (2)	8.50 (2)	7.00 (2)	4.00 (2)	1.50 (2)	$100.00 (2)

Table 3.—TCM and CVM values derived for coldwater fishing at designated sites in Idaho (sample size in parentheses)—Continued

Site	TCM	Contingent Value Method (CVM)							
	Net WTP for current conditions	Net WTP for current conditions	Net WTP for double no. of fish caught	Net WTP for 50% increase in fish size	No. of fish caught on last trip	No. of days fished on last trip	Hours fished per day	No. of licensed anglers	Cost (travel, food, tackle, accommodations)
22	$34.37	$70.11 (9)	$82.33 (9)	$83.22 (9)	7.89 (9)	3.17 (11)	4.09 (11)	3.27 (11)	$166.27 (11)
23	$42.57	$37.21 (44)	$52.84 (44)	$60.21 (44)	4.11 (46)	2.02 (54)	4.56 (54)	2.32 (54)	$68.42 (50)
24	$37.37	$26.79 (38)	$33.42 (38)	$39 .79 (38)	5.45 (38)	2.01 (46)	4.45 (46)	2.61 (46)	$37.33 (46)
25	$34.44	$18.33 (21)	$29.67 (21)	$32.86 (21)	7.58 (24)	1.95 (28)	5.54 (28)	3.00 (28)	$38.39 (28)
26	$42.41	$15.00 (1)	$16.00 (1)	$16.00 (1)	6.00 (1)	1.00 (1)	3.00 (1)	2.00 (1)	$2.00 (1)
27	$41.65	$17.50 (48)	$23.04 (48)	$27.56 (48)	7.22 (49)	1.61 (63)	4.30 (63)	2.32 (63)	$34.81 (63)
28	$42.41	$9.56 (16)	$11.06 (16)	$13.25 (16)	9.18 (17)	.96 (21)	4.19 (21)	2.33 (21)	$23.81 (21)
29	$37.72	$15.40 (5)	$21.40 (5)	$21.40 (5)	.80 (5)	1.38 (6)	4.50 (6)	2.17 (6)	$32.00 (6)
30	$62.00	$21.79 (29)	$25.72 (29)	$29.93 (29)	5.46 (28)	1.66 (34)	4.07 (34)	2.53 (34)	$34.18 (34)
31	$35.15	$18.44 (23)	$21.48 (23)	$25.57 (23)	3.61 (23)	1.39 (29)	5.07 (29)	2.66 (29)	$30.25 (28)
32	$42.56	$13.85 (27)	$19.26 (27)	$27.11 (27)	6.54 (28)	1.03 (42)	4.11 (42)	2.62 (42)	$17.20 (41)
33	$37.43	$24.50 (4)	$12.67 (3)	$11.00 (3)	2.00 (4)	1.00 (7)	3.93 (7)	2.57 (7)	$16.86 (7)
34	$34.31	$12.50 (2)	$15.00 (2)	$20.00 (2)	6.00 (2)	1.00 (2)	2.50 (2)	1.50 (2)	$23.50 (2)
35	$38.28	$26.54 (13)	$25.83 (12)	$37.62 (13)	5.71 (14)	1.21 (18)	5.61 (18)	3.22 (18)	$28.00 (18)
36	$37.85	$12.00 (10)	$15.56 (9)	$16.44 (9)	3.00 (10)	1.08 (13)	4.63 (13)	2.62 (13)	$14.54 (13)
37	$38.47	$22.20 (5)	$22.20 (5)	$35.60 (5)	4.20 (5)	1.20 (5)	3.40 (5)	2.60 (5)	$32.00 (5)
38	$34.17	$27.39 (28)	$37.82 (28)	$40.71 (28)	5.93 (28)	2.09 (33)	3.97 (33)	3.03 (33)	$46.27 (33)
39	$32.61	$42.50 (6)	$66.33 (6)	$50.33 (6)	4.50 (8)	3.33 (12)	5.08 (12)	3.17 (12)	$127.33 (12)
39	$32.61	$42.50 (6)	$66.33 (6)	$50.83 (6)	4.50 (8)	3.33 (12)	5.08 (12)	3.17 (12)	$127.33 (12)
40	$36.80	$26.87 (15)	$32.27 (15)	$40.87 (15)	6.38 (16)	2.22 (19)	4.08 (19)	2.26 (3)	$44.94 (18)
41	$36.87	$36.46 (11)	$64.55 (11)	$57.09 (11)	3.00 (11)	3.46 (11)	5.73 (11)	3.10 (10)	$69.64 (11)

Table 3.—TCM and CVM values derived for coldwater fishing at designated sites in Idaho (sample size in parentheses)—Continued

Site	TCM	Contingent Value Method (CVM)							
	Net WTP for current conditions	Net WTP for current conditions	Net WTP for double no. of fish caught	Net WTP for 50% increase in fish size	No. of fish caught on last trip	No. of days fished on last trip	Hours fished per day	No. of licensed anglers	Cost (travel, food, tackle, accommodations)
42	$42.25	$14.07 (62)	$21.69 (62)	$26.10 (62)	3.71 (63)	1.14 (76)	4.38 (75)	2.54 (76)	$21.12 (73)
43	$42.03	$61.50 (12)	$66.42 (12)	$82.50 (12)	5.25 (12)	1.43 (13)	5.23 (13)	3.00 (13)	$31.00 (13)
44	$42.48	$11.08 (12)	$16.00 (12)	$18.17 (12)	3.42 (12)	1.37 (18)	4.53 (18)	3.17 (18)	$30.77 (17)
45	$35.49	$13.00 (15)	$21.73 (15)	$23.60 (15)	2.75 (16)	1.28 (18)	4.83 (18)	2.72 (18)	$19.61 (18)
46	$32.84	$16.50 (14)	$20.71 (14)	$23.29 (14)	4.15 (13)	1.35 (17)	4.22 (18)	2.17 (18)	$25.83 (18)
47	$33.12	$12.67 (21)	$18.57 (21)	$18.52 (21)	4.29 (21)	2.22 (29)	5.01 (29)	3.21 (29)	$44.57 (28)
48	$38.24	$18.62 (13)	$29.42 (12)	$30.25 (12)	3.54 (13)	.92 (17)	4.07 (17)	2.82 (17)	$20.59 (17)
49	$35.97	$22.86 (14)	$23.23 (13)	$27.46 (13)	3.07 (14)	1.22 (16)	4.34 (16)	2.44 (16)	$26.27 (15)
50	$36.83	$10.08 (12)	$14.83 (12)	$18.00 (12)	4.42 (12)	1.06 (16)	3.53 (16)	2.38 (16)	$19.13 (16)
51	$30.11	$12.50 (2)	$22.50 (2)	$27.50 (2)	5.00 (2)	1.00 (2)	3.25 (2)	3.00 (2)	$20.00 (2)

small sample size in the warmwater fishing data which prevented estimates on an individual site basis for warmwater fishing..

Travel Cost Method

As discussed earlier, choice of functional form of the per capita demand equation was related to two factors. These were the Rao and Miller (1965) functional form tests and how well the log of visits per capita reduced heteroskedasticity. The Rao and Miller (1965) test indicated that log of visits per capita was preferable in terms of better fit of the data. In addition, the weighted regression resulted in neither substitutes nor quality being statistically significant. The log of visits per capita did minimize heteroskedasticity to the extent that estimated visits to the 51 sites for cold water and mixed fishermen were 19,116 while actual visits were 19,033. Estimated visits over all 51 sites were within 1.0% of actual visits. Since the main emphasis was on benefit estimation, this is acceptable. The difference between actual and estimated use for any individual site is likely to be greater than 1% and caution should be observed in using individual site averages as compared to State averages. For warm water fishing, the estimated visits were 5,710 while actual visits were 6,262. This was within 10%. The regression equation estimated using cold/mixed water fishing is given in equation [5]. This regression equation was used to calculate benefits for cold water fishing and cold/mixed water fishing.

$$\begin{array}{llll} \ln(\text{trips/pop}) = & -10.712 & -.00322\text{Dist} & +.00345\text{Totfish} \\ (\text{t statistics}) & (-6.23) & (-15.13) & (5.61) \\ & & -0.00000239(\text{Totfish})^2 & -0.015\ln(\text{Sub}) \\ & & (-4.37) & (-1.04) \\ & & +0.00134\text{Inc} & -0.00000015(\text{Inc})^2 \\ & & (2.48) & (-3.54) \end{array} \quad [5]$$

The estimated regression equation using warm/mixed data is:

$$\begin{array}{llll} \ln(\text{trips/pop}) = & -12.647 & -.002750\text{Dist} & +.00477\text{Totfish} \\ (\text{t statistics}) & (-4.05) & (-8.14) & (3.99) \\ & & -0.00000402(\text{Totfish})^2 & -0.0259\ln(\text{Sub}) \\ & & (-2.68) & (-1.13) \\ & & +0.1937\text{Inc} & -0.000000204(\text{Inc})^2 \\ & & (1.97) & (-2.66) \end{array}$$

The equations are highly significant overall with an F-value of 83 on cold water and 32 on warm water. The overall F and the individual t statistics on distance and

Table 4.—CVM and TCM values for warm/mixed water fishing by site grouping[1] (sample size)

Site grouping	A	B	C	D	E	F	G
TCM							
Net willingness to pay for current conditions	$50.55	$43.17	$41.12	$45.60	—[2]	$40.19	$37.91
CVM							
Net willingness to pay for current conditions	$10.20 (41)	$23.87 (15)	$18.96 (105)	$12.87 (15)	$27.00 (5)	$9.31 (13)	$12.86 (14)
Net willingness to pay for double number of fish caught	$16.10 (41)	$29.50 (14)	$24.93 (104)	$17.20 (15)	$30.40 (5)	$15.00 (13)	$19.71 (14)
Net willingness to pay for 50% increase in fish size	$17.85 (40)	$29.13 (15)	$28.95 (102)	$18.93 (15)	$27.80 (5)	$25.15 (13)	$23.57 (14)
Number of fish caught on this trip	9.02 (43)	8.13 (15)	8.32 (108)	7.69 (16)	2.20 (5)	5.15 (13)	8.80 (15)
Number of days fished on this trip	1.38 (61)	1.74 (19)	1.45 (137)	1.72 (18)	2.17 (9)	.82 (16)	1.45 (19)
Hours fished per day	4.57 (61)	4.13 (19)	4.69 (137)	4.43 (18)	4.33 (9)	4.40 (16)	5.06 (19)
Number of licensed anglers	2.49 (61)	2.95 (19)	2.68 (136)	2.22 (18)	2.56 (9)	2.88 (16)	3.47 (19)
Cost (travel, food, tackle, and accommodations)	$23.03 (61)	$28.79 (19)	$29.54 (137)	$31.39 (18)	$86.67 (9)	$12.00 (17)	$39.58 (19)

[1] *Warmwater groupings of fishing areas: A—2, 3, 4, 5, 6, 7, and 8; B—9, 10, 11, 16, 17, and 18; C—19, 24, 25, 26, 27, 28, 29, 33, and 34; D—30, 31, 32, 35, and 36;E—38, 39, 40, 41, and 43; F—42, 44, 46, and 47; G—37, 45, 48, 49, 50, 51.*

[2] *No TCM values recorded for these areas.*

quality are significant at the 99% level. The small standard error on distance for both warm water and cold water fishing provides a relatively small sensitivity interval around the benefit estimates. The R^2 was 0.40 for cold water fishing and 0.36 for warm water fishing. The t statistic on substitutes is not statistically significant at standard levels. However, given the theoretical importance of substitutes, omission would bias the distance coefficient. The advantages of leaving in this theoretically significant variable is greater than the cost of omitting it from a statistical standpoint (Kelejion and Oates 1974).

Distance to cost-effective substitutes and distance to the site under study have a very low but positive correlation. What this positive correlation implies is that as one moves away from the site j under study, one also becomes further away from substitute sites. Failure to include a substitute term under these conditions will overstate benefit estimates (Caulkins et al. 1985). Given this spatial pattern, the slope coefficient on the demand curve will be too price inelastic due to failure to account for distant users. The reason there is relatively little drop off in visits per capita from more distant zones is not solely price insensitivity but rather fewer substitutes available. Correcting for substitutes flattens out the demand curve in this case. This has the effect of reducing the benefit estimates (average and total consumer surplus).

The per capita demand curves were used to arrive at a second stage demand curve for each fishing site. This was done by setting the values of total fish at that site's value and setting income at that origin's value. Then distance was set at its current value for a given origin to calculate estimated visits per capita at current distance. Visits per capita were then multiplied by the origins population to calculate visits from the origin. Next, 200 mile increments were successively added to distance until the maximum observed distance in the sample was reached or visits from that origin fell to less than one. This takes into account the market area and provides an upper limit for integration which is necessary with the log of visits per capita functional form. This procedure of using highest observed distance as an upper limit was first used by Wennergren (1967) and since then by others (Smith and Kopp 1980). This rule yields a conservative estimate of the surplus because it cuts off some of the consumer surplus. In this application the amount of consumer surplus lost was about 70 cents a trip for warm water fishing.

The average economic efficiency TCM benefits for all sites is given in table 5. The average TCM cold water fishing values are $42.93 per trip or $25.55 per day. On

Table 5.—Average cold, cold/mixed, warm and warm/mixed values from Travel Cost Method.

	Cold water fishing	Cold/mixed water fishing	Warm/mixed water fishing	Warm water fishing
Net willingness to pay for current conditions per trip.	$42.93[1]	$39.43[2]	$42.44[3]	$42.18[4]
Number of days fishing on this trip	1.68	1.58	1.56	1.61
Number of hours fished per day on this trip	4.8	4.8	5.06	5.0
Value per day	$25.55	$24.96	$27.21	$26.36
Value per 12-hour RVD	$63.87	$62.40	$64.53	$63.26

[1] *95% Sensitivity Interval: $38.13 to $48.84*
[2] *95% Sensitivity Interval: $32.56 to $41.40*
[3] *95% Sensitivity Interval: $34.25 to $54.54*
[4] *95% Sensitivity Interval: $35.08 to $55.86*

a 12-hour RVD basis this is $63.87 per day. The value of mixed species fishing that is similar to cold water fishing (or cold water species dominant) is $39.43 per trip. For mixed fish species fishing that is similar to warm water fishing (or warm water fish species dominant) the value is $42.44. Warm water fishing values are $42.18 per trip or $26.36 per day. Putting this on a 12-hour RVD basis yields $63.26 for warm water fishing. The cold water fishing values for each of 51 sites can be found in table 3. The small sample sizes precluded calculating warm water fishing values by site; these values are shown by fishing regions in table 4.

Comparison to Other TCM Studies

The Idaho cold water fishing value of $25.55 per day is similar to the value of $19.49 per day found by Vaughan and Russell (1982) as a national average. It is also similar to the updated value of $22.39 per day estimated by Martin et al. (1974). Recent unpublished work by Miller and Hay[6] using the USFWS National Survey of Fishing, Hunting, and Wildlife Associated Recreation estimated a value of $24.00 per day for cold water fishing in Idaho. This value is almost identical to the State average estimated in this report.

Comparison of TCM Values to CVM Values

The appropriate CVM values to compare to TCM are CVM values for primary purpose trips. The CVM values are generally lower than TCM for both warm water and cold water fishing. One possible reason is that the CVM bids are for the angler's last trip while the TCM applies to all trips that year. If the last trip is not quite typical of all trips taken, the values would differ. Unlike hunting which has a very short season and a bag limit of one animal, people can take numerous fishing trips over the year. As such, the last trip of the year may be worth less at the margin than the first trip of the year. Since CVM is based on this last trip it may reflect a marginal value to the individual that could be below the average consumer surplus over all trips (Gum et al. 1983).

Use of confidence intervals for CVM and sensitivity intervals for TCM can assist in this comparison of CVM and TCM values. In this comparison the edited CVM values (reported in the brackets of table 1) for cold and warm water fishing are used. For cold water fishing the CVM value per trip was $22.52 with a 95% confidence interval of $19.55 to $25.08. The TCM value for cold water fishng was $42.93 per trip with a 95% sensitivity interval of $38.13 to $48.84 per trip.

Comparison of warm water fishing trip values shows CVM with a mean of $16.35 and 95% confidence interval of $10.36 to $22.34. The TCM trip values for warm water fishing had a mean of $42.18 with a 95% sensitivity interval of $35.08 and $55.86 per trip.

These confidence intervals seem to indicate the CVM values are lower than the TCM ones. This is similar to what Miller and Hay found in the USFWS National Survey of Fishing and Hunting.

Application

To evaluate the benefits of a possible fisheries management action the net economic value per RVD should be utilized. As a simple example, suppose the fisheries biologist estimates that fish populations would double if streambank improvements were made along riparian areas. The biologist, recreation planner, and economist could then translate this doubling in fish population into an increase in fish available for harvest. Once the increase in fish available for harvest is known, the theoretically correct way to calculate the additional long run benefits of this change is to use this new level of harvest as a demand curve shifter. When fish harvest goes up, the demand increases. This can be seen in figure 2 as the shift from D_1 to D_2. The improvement in quality will be translated (in the TCM) into existing anglers taking more trips and non-anglers entering (or reentering) fishing to become anglers due to the higher quality. The theoretically correct benefits of the increase in quality

[6] *Personal communication with Dr. John Miller, University of Utah, Salt Lake City.*

is equal to the shaded area between the demand curves. This is the long run value since we have allowed for entry of new anglers in response to the improvement in quality. Discussion of how to calculate the initial short run value of the change will be discussed below in conjunction with information about application of the Contingent Valuation Method.

In field studies it has been difficult for biologists to have access to the original TCM data, per capita demand curves for each site and a computer program to calculate benefits with quality-induced demand shifts. Often the biologist will be able to translate the increase in fish populations to an increase in supply of fishing trips. The economic benefit of the added fishing trips that there is a demand for can be approximated by multiplying the increase in trips times the average net value per trip. If there is a demand for an additional 300 fishing trips per year at a value of $42 per trip this would yield annual benefits of $12,600. In this case the approximation to the area between the demand curves is valid since the functional form of the demand curve is such that the average value equals the marginal value. This is not always the case, as is discussed in Appendix 1. This benefit would be compared to the annualized economic costs of stream improvements in riparian areas. These costs may take the form of water diversions, streambank stabilization or planting of vegetation. If the anglers' net willingness to pay (as revealed by the $12,600) for the additional fishing trips is greater than the annualized cost of stream improvements, then economic efficiency is improved by investing in stream improvements in riparian areas.

Evaluations of benefits of increased fish populations do not necessarily flow only from more angler days. In the short run, an increase in harvestable fish may be received by current anglers. For example, it may be several years before anglers believe this increase is a permanent change and for word of mouth to spread the news that fishing has improved. As a result, the benefits of higher harvests initially are obtained by current anglers only. To estimate the increase in value to current users we rely on Contingent Value questions asked in the survey. By increasing fish population, the demand

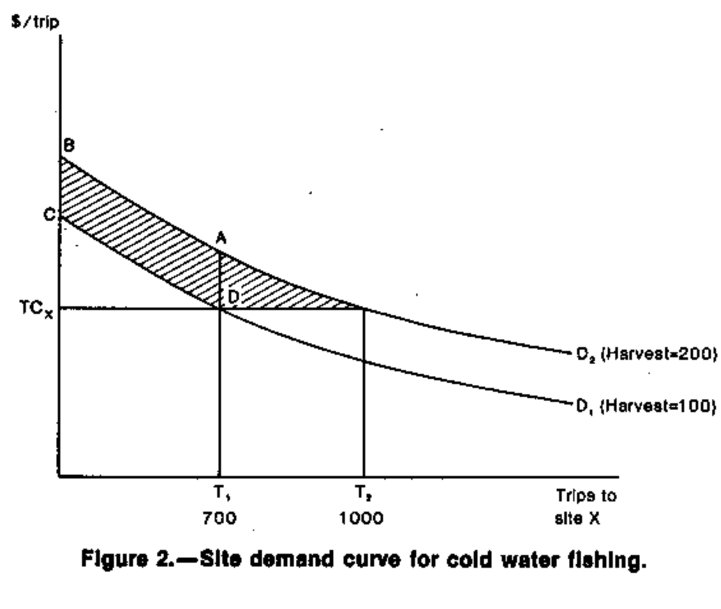

Figure 2.—Site demand curve for cold water fishing.

curve for the fishery resources shifts up to the right, leading to a higher value per day. These added benefits or marginal benefits can be calculated by taking the area between these two demand curves while holding number of trips constant. Such increases in value per trip are obtained directly from the bidding question. This study showed the value per trip would rise by about $8 if the number of coldwater fish caught doubled. If the size of the fish caught increased by 50% the value per trip rose by about $13 per trip. For warm water fishing these values are $8 more for double number of fish and $10 more for a 50% increase in size of fish. In terms of figure 2, the benefits being calculated here represent just the area between the demand curves for the current 700 trips (area ABCD). Continuing our example, if when fish populations double, fish harvest to existing anglers also doubles, then the CVM values can be used to calculate the area ABCD. Doubling harvest would, according to our CVM results, increase the value of the existing 700 trips by about $8 per trip. This results in an increased value of $5,600 for doubling fish harvest to existing anglers. This, however, represents only about half the total long run benefits when existing anglers take more trips and new anglers begin to visit this site.

These added values can be very useful in evaluating changes in fishing regulations or resource actions that will change the number of fish harvested or the size of fish caught. Decisions made by integrating these economic values into project analyses of timber sales, grazing allotment management, right of way design and fish restoration investments are likely to result in increases in net public benefits as compared to current undervaluation of fisheries values.

CONCLUSIONS AND RECOMMENDATIONS

The objective of this study was to derive recreational values for fishing using data collected by the Idaho Department of Fish and Game. The Travel Cost and Contingent Value Methods were applied in accordance with the U.S. Water Resources Council Principle and Guidelines (1983) and accepted professional practices. A Regional Travel Cost Model was constructed. The per capita demand curve included statistically significant variables on distance, income, quality and substitutes.

Both the Travel Cost and Contingent Value Methods had advantages and disadvantages in this study. The advantage of CVM was the ability to value not only primary purpose-primary destination trips but also secondary purpose or multi-destination trips. For cold and warm water fishing this is a large advantage since over 20% of the trips were not primarily for fishing. In addition, CVM provided values for doubling the number of fish caught or increasing fish size. There appeared little trouble in getting people to participate in the bidding game. One limitation of CVM was that it could reasonably be applied only to the last trip because applying the bidding sequence to each trip would have more than doubled the length of the interview and caused respondent fatigue.

The primary advantage of TCM relates to its reliance on actual behavior and applicability to all trips taken during the season. However, the disadvantages relate to inability to value multi-purpose or multi-destination trips and in selecting a value of travel time. The multi-destination or multi-purpose problem is not a serious shortcoming but is of some concern as TCM cannot value 20% of the trips taken to these 51 sites. The Regional or Multi-Site TCM, as applied in this study, has the advantage of being able to predict how many additional trips (or with some additional calculations, anglers) would be taken if the number of cold and warm water fish harvested doubled.

Perhaps the biggest practical disadvantage of TCM is the time it takes to construct and apply a Regional Travel Cost Model. A total of 40 work days (by two economists) were needed in this study to apply TCM. This time estimate involves economists familiar with mechanics of TCM, regression analysis, and computers. TCM, as applied in this study, also involved use of several specialized computer programs designed to shorten the time necessary to aggregate individual data into zones, calculate substitute indices, calculate second stage demand curves, and calculate benefits. These programs will be documented and made available to others in the future.

By contrast, the CVM analysis of mean willingness to pay takes relatively little time. Thus, if a survey must be performed to collect data for valuation, CVM is quite a bit faster in terms of data compilation and statistical analysis. However, if origin-destination data already exist in the form of permits or license plate numbers, then TCM would become a more cost-effective way to value recreation activities. In conclusion, no method is superior in all cases but both yield fairly consistent, although not identical results.

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Appendix 1

Average and Marginal Consumer Surplus—Conditions of Equality

This appendix discusses the issues of average versus marginal values in the context of application of study results to forest planning and project studies (e.g., environmental assessments). To correctly apply our study results the analyst should know how the change in demand for trips to this site is occurring. One possible way is due to population growth in the counties surrounding the site under study. Another way results from management actions taken by an agency changing the demand for wildlife recreation by changing site characteristics (e.g., harvest) or site location (e.g., travel cost or price) to some counties of recreationists origin. Population changes and changes in site characteristics are reflected in our TCM demand curves as a shift in the second stage demand curve. The area between the "with and without" condition demand curves is the appropriate measure of the change in net economic value or economic welfare as measured from the standpoint of economic efficiency (Freeman 1979). In the case of a reduction in travel cost to the site due to an addition of a new site closer to at least one county of origin the change in consumer surplus due to the price change reflects recreationists willingness to pay or the net economic value of such a change (Burt and Brewer 1971).

The area between the "with and without" TCM demand curve provides an estimate of the long run economic benefits of the change in, say site quality, due to some management action. This is termed long run because in the TCM model the change in quality will be translated into a change in number of trips taken by existing visitors to this site as well as entry of new recreationists due to the added incentive to visit this site due to improved quality. The reason that trips increases is that if the recreationist was in consumer equilibrium before the change, the improvement in site quality will throw the consumer out of equilibrium. That is the marginal utility of another trip is now higher and the price of another trip has not changed, so the marginal utility per dollar of visiting this site another time is now higher than alternative uses of that income. Therefore the consumer "reoptimizes" his or her consumer bundle and continues to take more trips to the site until they drive the marginal utility per dollar into equilibrium with all other goods.

In addition to being able to calculate benefits, the TCM demand curves simultaneously provide an estimate of the change in trips (which could be converted to the change in RVDs) associated with the change in site characteristics, change in population or a change in site location. This may be of value in addition to the change in benefits. For example, the change in trips times the recreationists expenditures would be useful in IMPLAN or other input-output models to estimate the local economic impacts.

The area between two CVM derived demand curves derived in our survey, represent just the short run benefits of the increased quality. By short run benefits we mean the increase in value to the existing recreationists taking their current number of trips only. This is represented by taking the area between the two demand curves but only up to the current quantity of trips taken. Thus, it is short run since, the way we asked the question, we get the added value of existing trips due to improved harvest quality but do not allow for the recreationist to get to the new equilibrium number of trips associated with higher quality. CVM questionnaires can be designed to ask individuals how number of trips would change based on a change in quality.

To carry out this theoretically correct application of our results the analyst would need access to the raw data (containing current travel cost, county population and current value of site characteristics) and a program to calculate the second-stage demand curve. At the present time it is not envisioned that many potential field users of this informatin would have access to the data and computer program. Until the benefits program is made easier to use or a program is maintained for each species, it would be difficult for field persons to actually shift the demand curves and recalculate benefits.

The question often posed in field studies is "Given that I have this change in trips or RVDs, what is the value that I should multiply these trips by to get the correct estimate of benefits?" The temptation is to use the average consumer surplus per trip or RVD times the change in trips or RVDs to calculate the change in benefit. The question is really about how good or bad is this procedure as an approximation to the theoretically correct area between the demand curves? Vaughan and Russell (1982) have shown that the goodness of this approximation depends on the functional form of the demand curve from which the average consumer surplus was estimated. If the demand curve is linear, Vaughan and Russell (1982) show that multiplying the original average consumer surplus times the change in trips will understate the true benefits by at least 50 percent. If the demand curve is a double log, then this procedure will over or understate the true benefits depending on the price elasticity of the double log function.

The demand curves estimated in this study generally use the natural log of visits per capita as the dependent variable and untransformed distance as the price variable. This is known as a semi-log model. In the semi-log model the average consumer surplus equals the marginal consumer surplus. That is the net benefits of another trip (due to an increase in population, increase in site quality or reduction in travel cost) is equal to the average consumer surplus. The proof is as follows:

The objective of the proof is to show that average benefits are equal to marginal benefits in relation to the per capita (stage I) demand curve. The means to accomplish this is to derive the mathematical expression for the benefits in each case and to show these are equal. The conditions under which this is true are:

1. Demand relationships between visits per capita and price (cost of travel) can be validly modeled with a semi-log functional form such as

$$\ln(q) = a - bp \qquad [A1]$$

or equivalently,

$$q = e^{a-bp} \qquad [A2]$$

where q is quantity, in this case, visits per capita

p is price, in this case, travel cost
a is the intercept parameter
b is the slope parameter

2. The only shifting variables allowed in the equation affect the intercept. No slope shifting variables are in the equation.

3. A slight relaxation of condition 2 occurs if there are slope shifting variables but they do not change from the "before" to the "after" states.

4. Each origin is a price taker in that people from that origin may visit the site as many times as they desire at their current travel cost. Therefore, the supply curve facing a given origin is horizontal. Due to differences in location from the site, each origin faces a different horizontal supply curve.

The "Before" State

Figure A1 shows the overall scope of the changes considered in the proof. At equilibrium in state 1, i.e., the "before" state, the demand curve has a quantity intercept of e^{a_1} when price is zero. As price increases, quantity decreases and asymptotically approaches zero for very large p. For a price of p_1, visits per capita to a site from a specific origin are q_1.

Total benefits per capita that accrue to the presence of the site, given all other existing sites, are represented by the shaded area labeled CS_1 (consumer surplus in state 1). This area is found by integrating under the demand curve and above the price line p_1.

Let a small segment of the area, dCS, be

$$dCS = q\,dp \qquad [A3]$$

as shown in figure A1.

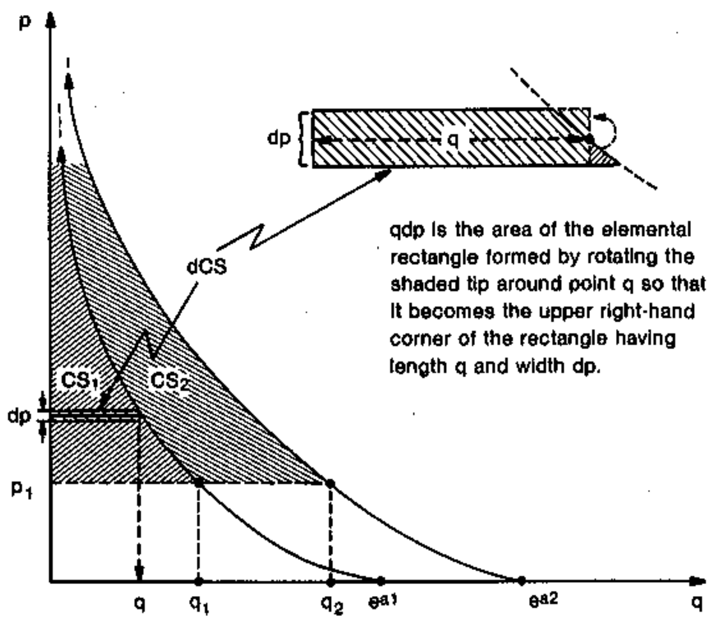

Figure A1.—Changes in consumer surplus.

Then

$$CS = \int dCS = \int_{p_1}^{p} q\,dp \qquad [A4]$$

The limits of integration define the lower boundary of the CS area, the p_1 price line, and the upper boundary of the CS area, the point where p goes to infinity and q goes to zero. In spite of these extreme values, it turns out the CS area is finite.

Substitute for q from equation [A2] in the integral in equation [A4] giving

$$CS_1 = \int_{p_1}^{p} e^{a_1 - b_1 p}dp \qquad [A5]$$

where the subscript 1 denotes state one ("before"). Continuing with the integration gives

$$CS_1 = e^{a_1}\int_{p_1}^{p} e^{-b_1 p}dp = -\frac{1}{b_1} e^{a_1 - b_1 p}\Big|_{p_1}^{p} \qquad [A6]$$

Evaluating the expression in [A6] at the limits of integration gives

$$CS_1 = \left(-\frac{1}{b_1} - e^{a_1 - b_1 p}\right) - \left(-\frac{1}{b_1} e^{a_1 - b_1 p_1}\right) \qquad [A7]$$

$$CS_1 = \frac{1}{b_1}\left(e^{a_1 - b_1 p_1} - e^{a_1 - b_1 p}\right) \qquad [A8]$$

In order to include the entire area under the demand curve, let p (not p_1) become infinitely large, (∞). For large p

$$e^{a_1 - b_1 p} = q \rightarrow 0 \qquad [A9]$$

so that the expression for CS in [A8] becomes

$$CS_1 = \frac{1}{b_1}\left(e^{a_1 - b_1 p_1}\right) = \frac{q_1}{b_1} \qquad [A10]$$

Average consumer surplus in state one per trip made (q_1) is

$$\overline{CS_1} = \frac{CS_1}{q_1} = \frac{1}{b_1}\left(e^{a_1 - b_1 p_1}\ \frac{1}{q_1}\right) \qquad [A11]$$

But

$$e^{a_1 - b_1 p_1} \text{ is } q_1, \qquad [A12]$$

So

$$CS_1 = \frac{1}{b_1}$$

Thus, average consumer surplus per trip in state one, the "before" state, is simply the inverse of the slope parameter from the demand equation, assuming the conditions previously stated are met.

The "After" State

Now assume that managers of the recreational sites under consideration wish to increase the attractiveness of the specific site, for example, by increasing the number of animals or fish potentially harvestable. This new condition becomes the "after" state.

The new attractiveness at the site increases the intercept to e^{a_2}, but does not affect the slope coefficient b, as we have assumed, so $b_1 = b_2 = b$, (i.e., quality is an intercept shifter only). Using the result of the previous section, that, in general under the stated conditions,

$$CS = \frac{1}{b}\left(e^{a-bp}\right) = \frac{q}{b} \qquad [A13]$$

and placing the subscript (2) for the "after" state on the variables, total per capita consumer surplus for the "after" state is

$$CS_2 = \frac{1}{b_2}\left(e^{a_2 - b_2p}\right) = \frac{q_2}{b_2} \qquad [A14]$$

Note that "after" average CS is also $\frac{1}{b_2} = \frac{1}{b}$.

The total change in consumer surplus from the "before" to the "after" state is

$$\Delta CS = CS_2 - CS_1 \qquad [A15]$$

$$\Delta CS = \frac{q_1}{b_2} - \frac{q_2}{b_1} \qquad [A16]$$

But, as noted, $b_2 = b_1 = b$

So

$$\Delta CS = \frac{q_2 - q_1}{b} \qquad [A17]$$

The marginal change per unit increase in trips is defined as

$$\frac{\Delta CS}{\Delta q} = \frac{\frac{q_2 - q_1}{b}}{q_2 - q_1} \qquad [A18]$$

So

$$\frac{\Delta CS}{\Delta q} = \frac{1}{b} \qquad [A19]$$

And since $b = b_1 = b_2$, combine the results of the derivation of "before" average consumer surplus and the derivation of the marginal consumer surplus caused by the change to the "after" state.

Thus,

$$\overline{CS_1} = \frac{1}{b} = \frac{\Delta CS}{\Delta q} = CS_{marg} = \overline{CS_2} \qquad [A20]$$

and the proof is complete given that the preceding conditions are met.

Note in the proof that the relationship in equation [A20] does not depend on the price level even though figure A shows price unchanging. Neither do the key equations for "before" and "after" consumer surplus, equation [A10] and [A14], respectively. Under the stated conditions, there may or may not be a price change along with the demand curve shift. Regardless, it does not affect the equality between the "before" average consumer surplus and the "before" – to – "after" marginal change in consumer surplus. Moreover, the price may change in either direction without affecting the results.

Therefore, with this functional form multiplying the average consumer surplus of a trip or RVD times the change in trips or RVDs due to one of the three factors discussed above will result in an exact estimate of the area between the demand curve associated with that change in trips or RVDs. This is a result specific to this functional form. Therefore, if the field analyst has an idea of change in trips associated with some management action, one can calculate an estimate of the change in economic efficiency benefits associated with that change in days without having to shift the second-stage demand curve.

APPENDIX 2
Script for Telephone Interview of Idaho Fishermen

INTRODUCTION

HELLO, IS THIS THE RESIDENCE OF ______________________?
first and last name

If yes. *If no.* THE NUMBER I WAS CALLING IS ______________________
telephone number

AND I AM TRYING TO CONTACT ______________________.
first and last name

SORRY I BOTHERED YOU. (TERMINATE. CHECK NAME AND NUMBER.)

→ THIS IS ______________________ AT THE UNIVERSITY OF IDAHO. I
interviewer's name

AM CALLING FROM THE COLLEGE OF FORESTRY, WILDLIFE AND RANGE SCIENCES IN MOSCOW. WE ARE DOING A STUDY OF FISHING IN IDAHO. WE ARE TRYING TO DETERMINE THE ECONOMIC VALUE OF IDAHO'S WILDLIFE. ______________________'s
first and last name

NAME WAS GIVEN TO US BY THE IDAHO DEPARTMENT OF FISH AND GAME. IS HE/SHE THERE? MAY I SPEAK TO HIM/HER?

1. Respondent is on the phone

2. Respondent is called to phone

3. no

WHEN MAY I CALL BACK TO REACH HIM/HER? ______________ AND
date

______________ A.M./P.M. WOULD YOU TELL HIM/HER THAT I CALLED
time

AND THAT I WILL CALL BACK. THANK YOU.

→ THIS IS ______________ AT THE UNIVERSITY OF IDAHO. I AM CALLING FROM
interviewer's name

THE COLLEGE OF FORESTRY, WILDLIFE AND RANGE SCIENCES IN MOSCOW. WE ARE DOING A STUDY OF FISHING IN IDAHO. WE ARE TRYING TO DETERMINE THE ECONOMIC VALUE OF IDAHO'S WILDLIFE. YOUR NAME WAS OBTAINED FROM THE IDAHO DEPARTMENT OF FISH AND GAME'S LISTS OF LICENSE HOLDERS.

→ LAST WEEK WE SENT YOU A LETTER AND MAP THAT EXPLAINED A LITTLE ABOUT OUR STUDY. DID YOU RECEIVE IT?

yes

no → I AM SORRY YOURS DID NOT REACH YOU. IT WAS A BRIEF LETTER WE SENT SO THAT PEOPLE WOULD KNOW WE WOULD BE CALLING THEM.

→ 1. DID YOU FISH IN IDAHO THIS SEASON?

no ⟶ THANK YOU FOR YOUR HELP. THAT IS ALL THE QUESTIONS THAT I HAVE FOR YOU.

yes
↓
(SKIP THIS QUESTION IF THEY DID NOT RECEIVE THE LETTER)

2. DID YOU HAVE TIME TO LIST ALL THE FISHING TRIPS YOU TOOK THIS SEASON ON THE MAP WE SENT YOU?

yes ⟶ WOULD YOU READ ME YOUR LIST OF FISHING AREA NAMES AND THE CORRESPONDING MAP UNIT NUMBERS.

RECORD LIST ON SEPARATE SHEET
go on to page 4

no
↓
ON A PIECE OF PAPER, PREFERABLY THE ONE WE SENT TO YOU IN THE MAIL, LIST ALL THE FISHING TRIPS YOU TOOK THIS PAST SEASON. A LIST OF GENERAL LOCATIONS IS FINE. OUR GOAL IS NOT TO FIND OUT YOUR SPECIAL SPOTS. IN ADDITION TO THIS LOCATION, IF YOU HAVE THE MAP WE SENT, PLEASE DETERMINE THE MAP UNIT WHERE YOU WENT ON EACH TRIP. PLEASE TAKE A MOMENT TO MAKE YOUR LIST OF FISHING AREAS AND CORRESPONDING MAP UNITS. IF YOU WENT TO ONE AREA MORE THAN ONCE, JUST LIST THE AREA AND NUMBER OF TRIPS. LIST TRIPS FOR DIFFERENT TYPES OF FISH SEPARATELY.

PAUSE WHILE HE/SHE COMPLETES THE LIST. TRY TO GET THEM TO MAKE THEIR OWN LIST. YOU MAY WRITE THE LIST IF THEY DO NOT HAVE PAPER OR REFUSE TO WRITE IT OUT.

WOULD YOU READ ME YOUR LIST OF FISHING TRIPS.

NOTE 1. *IF AN INTERVIEWEE DOES NOT HAVE A MAP, IT IS YOUR DUTY TO GET ENOUGH INFORMATION TO ASSIGN A MAP UNIT NUMBER TO EACH GENERAL LOCATION.*

NOTE 2. *PROBE:* DID YOU INCLUDE TRIPS YOU TOOK WITH YOUR FAMILY, VISITING RELATIVES, FRIENDS, OR PEOPLE YOU WORK WITH?

NOW THAT WE KNOW HOW MANY TRIPS AND IN WHAT MAP UNIT YOU TOOK THEM, I WOULD LIKE TO ASK YOU SOME MORE DETAILED QUESTIONS ABOUT EACH TRIP. IF YOU MADE MORE THAN ONE TRIP TO AN AREA, PLEASE GIVE THE AVERAGE FOR THOSE TRIPS.

WAS THE PRIMARY PURPOSE OF YOUR TRIP TO ______________________________
general area

TO FISH?

yes

no → *(TERMINATE AND START NEW AREA)*

maybe → WOULD YOU HAVE VISITED THIS AREA IF FISHING WAS NOT AVAILABLE?

yes → *(TERMINATE AND START NEW AREA)*

no

→ WAS THIS AREA THE PRIMARY DESTINATION OF THIS TRIP?

yes → *(ENTER A "1")*

no

maybe → WOULD YOU HAVE MADE THIS TRIP IF YOU COULD NOT HAVE VISITED THE AREA?

no

→ *yes* → HOW MANY DESTINATIONS DID YOU HAVE ON THIS TRIP?

________________ AREAS

WHAT WERE THOSE DESTINATIONS?

→ HOW MANY TRIPS DID YOU MAKE TO ________________ (general area)?

________________ TRIPS

DID YOU DRIVE THE ENTIRE DISTANCE TO ________________ (general area)?

yes → *mode = 1*

no → WHAT DIFFERENT TYPES OF TRANSPORTATION DID YOU USE?
small plane, airline, horse, car, jet boat, etc.

FOR YOUR TRIP TO ________________ (general area), WHAT WAS THE APPROXIMATE TOTAL DISTANCE YOU TRAVELED? ________________ miles

COUNTING YOURSELF, HOW MANY LICENSED ANGLERS WENT IN YOUR VEHICLE TO ________________ (general area)? ________________ anglers

HOW MANY UNLICENSED CHILDREN FISHED? ________________ children

HOW MANY DAYS DID YOU FISH ON THIS TRIP TO ________________ (general area)?
(TO NEAREST HALF DAY)

ON AVERAGE, HOW MANY HOURS PER DAY DID YOU FISH?

________________ hours

WHAT WAS THE PRIMARY TYPE OF FISH YOU WERE TRYING TO CATCH?

1. *coldwater (trout) in mountain streams*
2. *coldwater in alpine lakes*
3. *coldwater in lowland lakes and reservoirs*
4. *landlocked salmon*
5. *warmwater - panfish*
6. *warmwater - bass, walleye*
7. *sturgeon*
8. *steelhead*
9. *mixed (any two or more of above)*
0. *warmwater - other*

ON AVERAGE, HOW MANY DID YOU CATCH (NOT KEEP)?

________________ fish

If this is the last area, go on to page 6.
If there are more areas, repeat from page 4 with other areas.

THAT IS ALL I NEED ABOUT THIS AREA. NOW I WOULD LIKE TO TALK ABOUT YOUR

TRIPS TO ________________ .
general area

GO BACK

NEXT, I WOULD LIKE TO ASK YOU SOME QUESTIONS ABOUT YOUR MOST RECENT FISHING TRIP. WHAT AREA DID YOU VISIT ON YOUR MOST RECENT TRIP?

________________ area

HOW MANY LICENSED ANGLERS WERE IN YOUR PARTY?

________________ people

HOW MANY DAYS DID YOU FISH ON THIS TRIP (TO NEAREST HALF DAY)?

________________ days

ON AVERAGE, HOW MANY HOURS DID YOU FISH EACH DAY?

________________ hours

WHAT WAS THE PRIMARY TYPE OF FISH YOU WERE TRYING TO CATCH?

1. *coldwater (trout) in mountain streams*
2. *coldwater in alpine lakes*
3. *coldwater in lowland lakes and reservoirs*
4. *landlocked salmon*
5. *warmwater - panfish*
6. *warmwater - bass, walleye*
7. *sturgeon*
8. *steelhead*
9. *mixed (any two or more of above)*
0. *warmwater - other*

THE NEXT FEW QUESTIONS CONCERN THE AMOUNT OF MONEY THAT WAS YOUR SHARE OF THE AMOUNT SPENT ON THIS TRIP.

PLEASE ESTIMATE THE AMOUNT SPENT ON TRANSPORTATION ON THIS TRIP.

$ ____________

PLEASE ESTIMATE THE AMOUNT SPENT ON FOOD, TACKLE, ETC. ON THIS TRIP

$ ____________

NOW, ESTIMATE THE AMOUNT SPENT ON ACCOMMODATIONS ON THIS TRIP.

$ ____________

WAS THIS TRIP TO ____________ (general area) WORTH MORE THAN YOU ACTUALLY SPENT?

no → *STOP HERE*

yes

→ NEXT, I WOULD LIKE TO ASK SOME HYPOTHETICAL QUESTIONS ABOUT THIS TRIP TO ____________ (general area). ASSUME THAT THE TRIP BECAME MORE EXPENSIVE, PERHAPS DUE TO INCREASED TRAVEL COSTS OR SOMETHING, BUT THE GENERAL FISHING CONDITIONS WERE UNCHANGED. YOU INDICATED THAT $ ____________ WERE SPENT ON THIS TRIP FOR YOUR INDIVIDUAL USE.

WOULD YOU PAY $ ________ (20% of cost) MORE THAN YOUR CURRENT COST RATHER THAN NOT BE ABLE TO FISH AT THIS AREA?

PROTEST - WILL NOT ANSWER

RECORD WHY?

1. *it's my right*
2. *my taxes already pay for it*
3. *no extra value*
4. *like to, but not able*
5. *refuse to put a dollar value*

yes

no → *work between 0 and 20% to find highest acceptable value. split the difference in half until you reach nearest $1 (less than $10) or nearest $5 (greater than $10)*

→ WOULD YOU PAY $ ________ (50% of cost) MORE THAN YOUR CURRENT COST RATHER THAN NOT BE ABLE TO FISH AT THIS AREA?

yes

no ⟶ *work between 20 and 50% to final highest acceptable value. split the difference in half until you reach nearest $1 (less than $10) or nearest $5 (greater than $10).*

WOULD YOU PAY $ ________ MORE THAN YOUR CURRENT COST RATHER THAN NOT
100% of cost

BE ABLE TO FISH AT THIS AREA?

yes

no ⟶ *work between 50 and 100% to find highest acceptable value. split the difference in half until you reach nearest $1 (less than $10) or nearest $5 (greater than $10).*

keep going until you receive a negative answer. Use 100% increments.

work between last two bids to find highest acceptable value.

After last bid

IS THIS AMOUNT, $________, WHAT YOU PERSONALLY WOULD PAY, NOT FOR ALL
bid

MEMBERS OF YOUR PARTY?

no ⟶ repeat bids for personal value

yes

HOW MANY FISH DID YOU CATCH ON THIS TRIP TO ________________ ?
general area

________ fish

NOW, SUPPOSE THAT INSTEAD OF ________ FISH, YOU COULD CATCH ________
\# caught double #

FISH. HOW MUCH, IF ANY, WOULD YOU INCREASE YOUR BID OF $ ________ ?

$________

NOW, SUPPOSE, THAT THE SIZE OF FISH YOU CAUGHT INCREASED 50% (FOR EXAMPLE, FROM 8" TO 12"). HOW MUCH, IF ANY, WOULD YOU INCREASE YOUR BID OF $ ________ ?

$________

THAT IS ALL THE QUESTIONS I HAVE FOR YOU. THANK YOU FOR TAKING THE TIME TO ANSWER THESE QUESTIONS. YOUR RESPONSES WILL BE VERY VALUABLE TO US.

GOOD-BYE.

Sorg, Cindy F., John B. Loomis, Dennis M. Donnelly, George L. Peterson, and Louis J. Nelson. 1985. The net economic value of cold and warm water fishing in Idaho. USDA Forest Service Resource Bulletin RM-11, 26 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

Net willingness to pay for cold and warm water fishing in Idaho was estimated at $42.93 and $42.18, respectively, with the Travel Cost Method, and at $22.52 and $16.35 per trip, respectively, with the Contingent Value Method. Willingness to pay was greater for increased catch or fish size.

Keywords: Cold water fishing, warm water fishing, economic value, travel cost method, contingent value method.

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